Peer-review report of

Huth, K.B.S., Keetelaar, S., Sekulovski, N., van den Bergh, D., & Marsman, M. (2024). Simplifying Bayesian analysis of graphical models for the social sciences with easybgm: A user-friendly R-package. e66366. https://doi.org/10.56296/aip00010

Round 1

Dear authors, good morning.

I have now read your paper carefully, and with the help of one expert reviewer, reached an editorial decision.

The reviewer appreciates the study for providing a user-friendly R package and tutorial for Bayesian analysis of graphical models, noting its practical significance and timeliness. They commend the authors for making the package accessible to researchers with limited quantitative backgrounds. After personally testing the package, the reviewer finds it user-friendly and poses several clarification questions and suggestions, such as:

1. Clarification on whether the `easybgm()` function can accept a correlation matrix or requires raw data.

2. Inquiry about the default burn-in period in the package and whether it can be specified.

3. Question on the possibility of specifying multiple chains for fitting the Bayesian graphical model.

4. A suggestion to demonstrate how to specify various prior distributions using the three R packages supported by `easybgm`.

5. Recommendation to include a summary or table in the manuscript that highlights the capabilities and limitations of each package, along with advice on selecting appropriate packages for assigning priors.

6. Appreciation for the clear explanation of differences among packages on Page 9, with a suggestion to add similar content for prior specifications.

7. Questions regarding the interpretation of Posterior Inclusion Probability (PIP) and how users can distinguish between PIPs from different packages.

8. Suggestion to include an example plot that interprets the structure plot showing the Bayes Factor of the most likely structure versus other structures.

9. Inquiry about how the visited structure is determined in `easybgm`.

10. Question regarding the lack of observed differences in outputs when modifying the `evidence_tresh` argument in the summary function.

The reviewer concludes by recommending manuscript revision to address these points and further enhance its utility.

After reading carefully the paper and the reviewer's comments, I agree with all points raised, and would like to suggest the following additional changes/improvements:

1. **Clarity and Structure**:

- The paper's abstract and introduction provide a good overview of the content. However, the transition between sections could be made smoother to enhance readability. Consider revising transitions to ensure a logical flow of ideas.

- The methodological background section could benefit from a more detailed explanation of Bayesian graphical modeling principles for readers who may be less familiar with these concepts.

2. **Technical Depth**:

- The section on specifying prior distributions is valuable, but it could be expanded to include more examples or case studies showing how different choices of priors can impact the model outcomes.

3. **Usability and Application:**

- The paper effectively demonstrates the package's application using a sample dataset. However, additional examples or case studies with varying data types and complexities could further illustrate the package's versatility and robustness. I recommend using at least one more empirical example/case study.

4. **Conclusion and Future Work:**

- The conclusion summarizes the paper well. It could be strengthened by explicitly stating the potential impact of this package on the field of psychometrics and its applications in other fields.

These suggestions aim to enhance the paper's clarity, depth, and practical applicability, potentially increasing its impact and usefulness to the intended audience.

Please, revise the manuscript and submit a detailed letter explaining what suggestions were incorporated in the updated manuscript, and which suggestions were not (with an explanation why they were not included in the revised manuscript).

Reviewer 1

The study provides a tutorial to an R package that implements Bayesian analysis of graphical models. The Bayesian method for graphical models is gaining increased attention. Developing a user-friendly R package and providing a tutorial on the application of the package is timely and of practical significance. After implementing the package following the manuscript myself, I find the package user friendly and have a few clarification questions that I'd appreciate if the authors could help with.

1. Can the data argument in easybgm() be a correlation matrix, or should the read-in data need to be in raw data format?

2. What is the default of the burnin period? Can it be specified?

3. Can users specify multiple chains when fitting the Bayesian graphical model?

4. One highlight of easybgm is its flexibility to specify various prior distributions for model parameters and graph structures by calling one of the three commonly used R packages. The authors did a nice job of introducing how to specify priors; it will be helpful to demonstrate how to do so under each package. For example, how to call different packages in order to specify hyperpriors.

5. Also for the prior section, it will be helpful to add a summary paragraph or table, demonstrating and highlighting the capabilities and limitations of each package. It would also be helpful to include the author's suggestions regarding which package under what scenarios when deciding to assign priors. Also, some packages share the same prior specification capabilities. Do the prior specifications across packages share the same features? If different, how are they different? For example, both BDgraph and bgms allow specifying priors for edge inclusions. Are their features similar or different? A summary or discussion in the manuscript would be helpful especially since easybgm is a user-friendly wrapper for these other packages.

6. On Page 9: I enjoy reading "The PIP is based on a model-averaged estimate when fitting the graphical model with BDgraph or bgms, while it is a single-structure estimate for graphical models estimated with BGGM." This clearly demonstrates the differences among packages. It would be nice to add a couple of similar expressions when introducing prior specifications and how they differ among packages implemented in easybgm.

7. I have some clarification questions about obtaining the posterior inclusion probability (PIP). Because different packages produce different PIPs (i.e., model averaged estimates versus single structure estimate), when obtaining PIPs from fit$inc_probs, how would end users know which PIP is from which package? Also, is the fit$inc_bf an inclusion BF calculated from Bayesian model averaging or is it a BF calculated from a single model?

8. It will be helpful to include an example plot that interprets the structure plot that shows the BF of the most likely structure versus each other visited structure, by using this code plot_structure_probabilities(fit,as_BF=TRUE)

9. How is the visited structure determined in easybgm?

10. In summary (fit , evidence_tresh = 10), I tried to modify the argument ```evidence_tresh=10``` and play around with different threshold (evidence_tresh=5, evidence_tresh=3). However, I did not observe any differences in outputs when modifying the evidence_tresh argument. Am I missing anything here?

In summary, the manuscript offers an R package and its tutorial that are user friendly toward researchers with limited quantitative background. The package and

manuscript are of practical significance and timely. I recommend revision of the manuscript.